SOME HABITS OF THE DYTISCIDÆ.*

By JOHN D. SHERMAN, Jr.,

BROOKLYN, N. Y.

The animal fauna of the water is said to be largely controlled by the character of the water bottom.

The Dytiscidæ, according to my experience, do not like very muddy bottoms. A few of our commonest species do occur in such bottoms, and in abundance, *c. g., Hydrovatus cuspidatus* Germ. and *Cœlambus inæqualis* Fabr.

But the number of these species is small, and ponds and brooks of the most promising appearance otherwise, but with very muddy bottoms, are usually very disappointing when you are looking for *Dytiscidæ*. These beetles prefer for their home bodies of comparatively clean live water, either spring-fed ponds or running brooks, where the bottom is at least moderately clean or sandy.

The presence of some vegetation, preferably small plants—especially those of a filamentous character, or submerged roots—is indispensable.

The almost absolutely clear mountain or forest lakes of the Lake Superior region contain little plant life at their borders, a fact which has been attributed, in the case of the larger lakes, to their greater exposure to the ice. They apparently contain few if any beetles. In the White Mountains of New Hampshire within a few miles of each other are five small "lakes," of approximately the same size at about the same elevation: the twin Carter Lakes, 3,150 feet high, Hermit Lake and Glen Lake in Tuckerman's Ravine, 3,700 feet, and Spaulding Lake in the Great Gulf, 4,150 feet. All of these except Hermit Lake are very clear and practically without either vegetation or beetles. Hermit Lake is rich in both, while Glen Lake, only a quarter of a mile distant, contains neither.

If the water is polluted, as for example by the presence of carrion, the Hydrophilidæ take precedence over the Dytiscidæ. On the other hand the presence of decomposing vegetable matter, such as dead and

* The new names suggested in this paper for certain well known species of *Hydroporus* will be more fully explained in a later paper, together with other notes and descriptions of new species.

even thoroughly decayed leaves, does not interfere with Dytiscidæ.

In the larger bodies of water it is very difficult to locate any beetles, and in them, whether swamps, ponds or rivers, the beetles seem to occur only in very limited spots which are usually separated from the main sheet of water, such as the eddies or the small pools along the shore. In fact the small water bodies are always best, and the time most favorable for collecting is when the water is low or almost dried up.

Comparatively wild regions are better than such finely and thoroughly cultivated places as say the Cumberland Valley in the vicinity of Chambersburg, Pa., or the big farms about Saint Paul and Rochester, Minn. In New Jersey and New York and Massachusetts and Virginia, where there are occasional wild spots scattered about, the Dytiscidæ are more plentiful. Mr. Schwarz once told me that he considered the presence of cattle unfavorable for Dytiscidæ, but Mr. Roberts did not find it so in his collecting in Bennington Co., Vt. If there are fish there are not so many beetles.

These water beetles are well known to be excellent flyers and are often attracted by electric or other lights. Correspondents in the Winnipeg region have written me of the hordes of *Dytiscus* which fly to the lights early in the spring and in the late autumn. *Cybister fimbriolatus* Say is often taken at lights hereabouts, while *Eretes sticticus* Linn. and *Laccophilus quadrilineatus* Horn are taken in this way at McPherson, Kans., by Mr. Knaus. Mr. Fuchs in California collects many water beetles, especially the Hydrophilidæ, at light, and so does Mr. Loding at Mobile, Ala. They are also collected at light in the desert regions, great distances away from any known water supply.

While mentioning these flights of water beetles it is worth while to recall Dr. Régimbart's interesting paper (Annals Ent. Soc. France, 1894) on Dytiscidæ found in the debris of tobacco leaves. About 50 species were listed, 17 of these being described then for the first time. These beetles and numerous species, nearly all small, of other families, were gathered from dried tobacco leaves through the efforts of Mr. Antoine Grouvelle, director at that time of the National Tobacco Monopoly of France. Dr. Régimbart stated that these insects were probably intercepted in their flight by the pubescence and stickiness of the tobacco leaves. It is also possible, he said, that some were

attracted by the rain water resting in the axilla of the leaves, and that others originated in the water with which the leaves were washed. The *Dytiscidæ* were chiefly of the genera *Canthydrus, Bidessus, Laccophilus, Desmopachria, Notomicrus, Hydrovatus, Celina,* and *Hydrocanthus,* as the tobacco came from southern countries. Two North American species (from Mexican tobacco) were mentioned—*Bidessus affinis* Say and *Bidessus pullus* Lec.

The Dytiscidæ are also often washed up on the ocean beaches and on the shores of the Great Lakes, by tide or wind, though none of the species live either in the ocean or in the open waters of the big Lakes.

Few species live in salt or brackish water. A few are often found in it, though most of such species occur also in water which is not salt or brackish. *Cœlambus impressopunctatus* Sch. is taken on the salt marshes of Staten Island, but this is a widely distributed species in the north, occurring both at the sea level and at high altitudes, both east and west. Mr. Loding, of Mobile, Ala., mentions *Coptotomus, Laccophilus proximus* Say and *fasciatus* Say, and *Thermonectes basilaris* Harr. as occurring in brackish water, and says the latter also lives in quite saltish water. The lately rediscovered *Agabus lineclus* Lec. lives in the salt marshes near San Francisco, Cal.

In an inlet of the Hudson River just below Peekskill, New York, where the river water is still salt, under stones, sticks, dead leaves or other debris on the mud at or below the high tide mark, *Copelatus glyphicus* Say used to be very common. This species is associated by Mr. Leng with cat-tails and he points out that with its thin flat body, it is well adapted to live among the cat-tail sheaves. The place near Peekskill was covered with an extensive growth of cat-tails. I believe Mr. Bischoff of Newark finds a number of species of Dytiscidæ in the cat-tail sheaves early in the spring, which have hibernated in this shelter.

Celina angustata Aubé occurs in some ponds on Staten Island where there is some iron in the water, and Mr. Shelford found some species in similar ponds near Chicago, Ill., but usually if the percentage of iron is great there are no beetles, *e. g.,* the pools along the eastern branch of the Potomac at Bladensburg, Md.

Dytiscidæ live both in very cold and in very warm water. Mr. Schwarz has taken *Deronectes striatellus* Lec. in water having a

temperature of 105 degrees Fahr. (and some Hydrophilidæ in still warmer water) while *Deronectes griseostriatus* De G. swarms in the icy springs or "lakes" above the tree line in the White Mountains, and in Labrador. As a rule, the species of *Cœlambus, Hydroporus, Ilybius, Agabus, Colymbetes* and *Dytiscus* are most abundant in colder climates, while *Canthydrus* and its allies, *Laccophilus, Hydrovatus, Celina, Copelatus* and *Cybister* are best represented in warmer regions.

Excluding the very large bodies of water—the large rivers, the big lakes, and the extensive swamps,—which, as before stated, are not favored by the Dytiscidæ, the various water bodies may be conveniently discussed, with reference to these beetles, under the following four heads.

I. The pond of the open meadow.

II. Ponds and pools of the forest with *sphagnum* as the characteristic living plant form, and dead and rotten leaves for a bottom.

III. Running brooks or small rivers.

IV. Small springs or wells.

I. The Meadow Pond.

This is the ordinary hunting ground of the collector. The other places are quite commonly neglected.

The Dytiscidæ living in the typical meadow pond are well described by Professor James G. Needham in his paper in the American Naturalist, August, 1907, in which is given a list of 29 species found in the "Gym" pond on the campus at Lake Forest, Illinois.

This pond is described as an artificial one, made by damming a short spring-fed brook, in which after several years conditions have become quite natural. The pond is about 200 feet by 100 feet, 15 feet deep near the dam, and shallow at the other hand, where it is filled with a dense clear growth of cat-tails (*Typha*), with very little other vegetation anywhere in the pond. The Dytiscidæ are found in the limited area of the typha beds.

The species listed are our common species of *Laccophilus, Hydrovatus, Bidessus; Cœlambus inœqualis* Fabr., *dispar* Lec., *acaroides* Lec., and *nubilus* Lec.; *Hydroporus undulatus* Say, *dichrous* Melsh. and *modestus* Aubé; *Ilybius confusus* Aubé; *Coptotomus interrogatus* Fabr.; *Agabus subfuscatus* Shp., and *disintegratus* Crotch; *Hydaticus piceus* Lec., *Acilius semisulcatus* Aubé and *fraternus* Harr., *Dytiscus*

hybridus Aubé, *Thermonectes basilaris* Harr., *Graphoderes cinereus* Linn., *Colymbetes sculptilis* Harr. ,and *Rhantus notatus* Fabr.

Almost the same species occur in similar meadow ponds in the vicinity of New York City. *Cœlambus acaroides* Lec. and *Rhantus notatus* Fabr., however, are western species exclusively. The genus *Rhantus* is commonly represented here by *binotatus* Harr. Two genera not mentioned by Needham contribute two common species to the meadow pond fauna, *Hydrocanthus iricolor* Say and *Desmopachria convexa* Aubé.

Needham calls attention to the general correspondence in the size of the various species with the depth of water in which they are found, *Dytiscus* being usually found in the deep water—two or three feet,—with *Acilius* adjacent on the shoreward side, and *Coptotomus* "in water a foot deep in the narrow aisles between the typha clumps. *Laccophilus* dwells amid the fallen stems and trashy accumulations nearer shore, *Hydroporus* and *Cœlambus* love the shoals into which one can look down while sitting on the bank, while *Bidessus* clings to the very shore line."

The Lake Forest pond is considerably larger than the ponds in which I have been most successful. Nor does the limitation of vegetation to the typha type sound especially attractive.

A collection of smaller ponds somewhat connected, and located in wilder country, like the ponds at the edges of the woods near the railroad trestle of the C. R. R. of N. J. crossing the brook a mile and a half north of Lakehurst, N. J.—ponds first explored by Mr. Leng and now familiar to us all—such a group of ponds provides an ideal home for the Dytiscidæ. About 40 species live in these Lakehurst ponds. *Cœlambus farctus* Lec. replaces *acaroides* Lec. of the Lake Forest list while *Rhantus* is represented by *calidus* Febr.—a more southern species.

In *Agabus* we have at Lakehurst *tæniolatus* Harr. and *æruginosus* Aubé. The presence of this genus suggests in each case the spring-fed nature of the ponds. In *Bidessus* there are *pulicarius* Aubé, which becomes commoner as we go further south, and also *fuscatus* Crotch, the latter being usually a forest species in the north. The genus *Canthydrus* is also represented at Lakehurst.

Canthydrus puncticollis Crotch, which has been considered a rare beetle, was found last May by Mr. Norman S. Easton at Fall River,

Mass., on pieces of old lumber in a small pond bordered on one side by cat-tails and pickerel weed, with meadow land on the shore; and on the other side full of sawdust and old lumber from an ice-house, with a wooded swamp further back.

Irrigation ditches are favorite places for collecting water beetles in many regions where there are few other collecting grounds, and under these conditions yield an abundance of species and specimens especially if there is some motion to the water.

II. PONDS AND POOLS OF THE FOREST.

In these the number of species is much smaller, but several of them seldom occur anywhere else.

My own favorite locality of this type at Peekskill, New York, where Mr. Roberts and I have collected so successfully, may be described as a swampy depression in the woods, a few hundred feet above sea-level, filled with several small ponds more or less connected. These ponds have for a bottom a deep bed of dead and thoroughly decomposed leaves, but contain very little living vegetation except some *Sphagnum* and in some spots a little grass. The woods are thick enough so that the ponds are moderately well shaded. There used to be a somewhat similar region in the woods adjoining the Moravian Cemetery at Middletown, Staten Island, and there are similar but smaller pools near the Great Falls of the Potomac on the Virginia side.

In all three places practically the same species occur as follows: *Bidessus fuscatus* Crotch, *Cœlambus laccophilinus* Lec., *Hydroporus tristis* Payk., *Hydroporus difformis* Lec., *Ilybius ignarus* Lec., *Matus bicarinatus* Say, *Agabetes acuductus* Harr., *Agabus semipunctatus* Kby., *Rhantus sinuatus* Lec.

The shaded ponds in Forest Park, Long Island, formerly furnished some of these species, but lately these ponds have become contaminated and most of the vegetation has been destroyed, so that this fauna has largely disappeared.

While the living vegetation of these forest ponds is not extensive, the little there is, seems to be essential. At Peekskill last year we found that the vegetation had been mostly killed perhaps by the drought of 1911, and water beetles were extremely scarce. At Peekskill too, the forest is gradually disappearing, and with it, no doubt, these Dytiscidæ also.

In the same woods at Peekskill, in isolated deep spring-like pools full of dead leaves, *Agabus gagates* Aubé is a common species and practically the only one found in them.

In more open spots in the woods at Tyngsboro, Mass., the ponds contain *Hydroporus tenebrosus* Lec. and *despectus* Sharp, and *Ilybiosoma bifaria* Kby. as well as several other species.

In still more primitive forest growths than the Peekskill one—in the sphagnum pools like those at the upper end of Hermit Lake 3,700 feet high on the east side of Mt. Washington, N. H.—and in the very similar pools near the shores of the small lakes in the vicinity of the Huron Mountain Club, on the south shore of Lake Superior, we find

Scutopterus angustus Lec.....Both places.
Scutopterus Horni Crotch.....Lake Superior.
Ilybius pleuriticus Lec.....Both places.
Ilybius discedens Sharp.....Both places.
Agabus anthracinus Mann.....Hermit Lake.
Agabus inscriptus Crotch.....Hermit Lake.
Agabus semipunctatus Kby.....Both places.
Hydroporus tristis Payk.....Both places.
Hydroporus n. sp. near *despectus* Sharp.....Hermit Lake.
Dytiscus dauricus Gebl.....Hermit Lake.

The common species of *Sphagnum* at Hermit Lake is *Girgensohnii* Russ. of the *S. acutifolium* group, as kindly determined by Dr. Andrews through Mr. Davis.

Of the forest pond Dytiscidæ cited in these two tables, *Hydroporus tristis* Payk. is quite often found in the more open ponds, while *Ilybius pleuriticus* Lec. occurs in the Glen mill pond near Glen House, N. H., about 1,600 feet elevation, and *Agabus anthracinus* Mann. was very common one season in the Watson ice pond near the Ravine House in the meadow at Randolph, N. H., 1,300 feet high.

Two of our eastern species of *Ilybius—confusus* Aubé and *biguttalus* Germ.—live in meadow ponds; *pleuriticus* Lec. lives both in meadow and in forest ponds, while *ignarus* Lec. and *discedens* Sharp seem to be forest inhabitants only.

The other forest water beetles mentioned are very seldom seen out of the woods.

This fact is easy to explain in the case of *Agabetes acuductus*

Harr., which is without wings and a very awkward beetle out of the water. Several of the species lack the agile swimming powers of most *Dytiscidæ*. *Hydroporus difformis* Lec., *Matus bicarinatus* Say, *Agabus semipunctatus* Kby. and even the big *Scutopterus,* are very deliberate in their movements and may be said to crawl rather than anything else.

Many of these forest species seem able to live where there is little actual water, provided there is some moisture. Wickham in his list of Bayfield, Wis., beetles says "a large part of the species of water beetles were taken not in water, but under moss in damp spots, a peculiarity which I have noted in some species of *Agabus* collected on a previous trip to Alaska." Adams refers to this in his book on Isle Royale. Shelford one year found *Matus bicarinatus* Say quite common under old logs in damp places at Pine, Ind., and Mr. Loding in Alabama says of this beetle "always under sphagnum moss in a moist partly dried up swamp."

The water-beetles of the forest are for the most part black or dark in color, especially those species living in the deepest and darkest woods. The very black rich earth of their habitat, and the comparative lack of sunlight, undoubtedly affect the coloration of the beetles, as is commonly believed. The species living in open meadow ponds are much oftener pale in color or markings, *e. g., Hydrocanthus, Laccophilus, Cœlambus, Coptotomus, Rhantus binotatus* Harr. and *calidus* Fabr., *Colymbetes sculptilis* Harr., etc.

III. Bodies of Running Water.

While the Parnidæ live almost exclusively in running water, the number of species of Dytiscidæ so found is small by comparison with the number living in ponds. But these species are very interesting and indeed seem to possess a certain nobility of appearance, nearly all of them being very bright, shining and clean looking. As Dr. Régimbart advised his correspondents, "they live usually along the edges of shallow streams, nearly always in small brooks in whose beds are stones, and along whose edges there are masses of the half floating roots of aquatic plants."

The genus *Hydroporus* furnishes most of the species of Dytiscidæ found in running water. Of this genus *pulcher* Lec., *mellitus* Lec., and *striato-punctatus* Melsh. live in the shallow places of the smaller

peaceful brooks with clean sandy bottoms, like the one running through the golf course near the Moravian Cemetery on Staten Island.

Shelford took *Hydroporus mellitus* Lec. in great quantities at South Haven, Mich., "in the sand near the edges of very shallow pools left in a partly dry brook, waiting several minutes for the beetles (which are exactly the color of sand) to crawl out."

Hydroporus vittatus Lec. was also found by Shelford in abundance in the gravel at Edge Brook, Ill., near the shore of the old course of the Chicago River. This gravel was full of filamentous algæ. I first saw this beautiful beetle alive at Chester, Minn., in a small sandy pool left in the almost dried up bed of a good sized brook, and a few days afterward I accompanied Professor Shelford's class on one of their memorable picnics to the Edge Brook locality and took a great many more.

Hydroporus concinnus Lec. (*wickhami* Zaitzev.) I have usually found in brooks where cress was growing, brooks usually with muddier bottoms.

Hydroporus spurius Lec. lives among the submerged roots of plants living on the banks of deeper and larger brooks.

Hydroporus solitarius Sharp also lives in the larger brooks or small rivers (Pine River, Lake Superior; Ten Mile River, Wingdale, New York; Black Creek, Esopus, New York).

Hydroporus septentrionalis Gyll. has been found rather common in recent years by Messrs. Sheriff and Frost at Fabyans, N. H., in the Ammonoosuc River, which is a rapid stream at that point. Mr. Sherriff says that "it confines itself to the water's edge, hiding under submerged stones."

Hydroporus cimicoides Sharp and *venustus* Lec. are two more species of this genus living in running water. Both of these are abundant in the clean sandy pool and brook flowing therefrom, at the bottom of the lake dam at Lakehurst, N. J.

Dytiscidæ of other genera also occur in running water.

In the eddies of the eastern branch of the Potomac River at Bladensburg, Md., and also in the brook running through my uncle's farm at Ash Grove, Va., are found the beautiful *Laccophillus* described in manuscript as *Schwarzi* by Mr. Roberts and also the fine undescribed *Hydroporus* to which I propose to give Zimmermann's mss. name of *dilatatus*.

In a brook in the woods at Marion, Mass., Mr. Bowditch and his friends find *Agabus gagates* Aubé in great numbers and deeper, among the submerged roots, the less active *Agabus planatus* Sharp. In my own experiences at Marion *gagates* outnumbered *planatus* about a hundred fold.

Another common brook species of *Hydroporus* both at Marion, Mass., and Ash Grove, Va., and elsewhere, is the beetle which has passed so long in collections as *vitiosus* Lec. and which was described under this name by Dr. Sharp, although it is really quite a different species for which I shall suggest the name *blanchardi*.

Deronectes depressus Fabr. and *Haliplus cribrarius* Lec., as well as *Hydroporus solitarius* Shp. occurred in the bed of the small "river" between Mountain Lake and Cliff Lake in the Huron Mountain region of Lake Superior, where the current is quite strong, the water being perhaps two or three feet deep and full of eel-grass.

Amphizoa lives in the swift mountain streams on the Pacific coast. So does *Hydrotrupes palpalis* Sharp, according to Fall.

Our smallest Dytiscid, *Notomicrus nanulus* Lec., is another interesting species living in running water, found by Mr. Schwarz in midsummer on the underside of logs swept against a bridge over the Pell River at Bartow, Fla.

One of the meadow pond species mentioned by Needham, *Cœlambus acaroides* Lec., lives also in the brook at Edge Brook, Ill. In July, 1911, I collected this species a few days apart, in a muddy pond near St. Paul, Minn., and at Edge Brook. The brook specimens were clean and bright; those taken in the muddy water were dark and dirty in appearance. This species and *Agabus gagates* Aubé are two of the very few brook species which are also at home in still water. The species of the genus *Agabus* however are more properly to be considered as belonging to the fauna of springs.

Sometimes, however, these brook species are carried away by freshets from their home and found elsewhere. An interesting instance of this came under my observation in August, 1903, when we were camping on Esopus Island in the Hudson River. The very heavy rains of that month converted into a torrent Black Creek which empties into the river opposite the island, and hundreds of specimens of *Hydroporus pulcher* Lec. were swept half way across the Hudson River to the shores of the island, where they were found under stones and pebbles at low tide.

On the other hand, in very dry seasons, when even the larger brooks and small rivers are almost dry, with only pools remaining in many portions of their beds, a great many of the ordinary pond species resort to these places, and at such times nearly all the native species are found in them.

IV. SPRINGS.

Characteristic species of the small springs in the north are *Agabus parallelus* Lec., *obtusatus* Say, *erythropterus* Say, and other species of the genus *Agabus*, while in *Hydroporus* we have *stagnalis* G. & H., *persimilis* Crotch, *oblitus* Aubé and their allies.

Agabus semivittatus Lec. usually lives in springs or along brooks where cress grows. Shelford first advised me of always finding this species under such conditions at South Haven, Mich., and I have since observed it occurring with the same plant in the Cumberland Valley, Pa., and at Rochester, Minn. Mr. Loding has a record of this or a closely allied species under sphagnum moss in a dried-up pond at top of Blount Mountain, Ala., 1,000 feet elevation.

On the Pacific coast *Agabinus glabrellus* Motsch. lives, according to Fall, in very cold mountain springs.

The genus *Siettitia* was erected for a beetle of the *Hydroporus* type found in France at the bottom of a deep well and *Hydroporus stagnalis* G. & H. occurs here in very deep spring holes which have been built up into the form of a well.

The small so-called "lakes" of the White Mountains, above the tree-line, have been to me an exceedingly interesting collecting ground and are I think entitled to some separate mention. These "lakes" are virtually large springs among the rocks usually lined with *Sphagnum*, or sometimes with grass. They seem never to fail to shelter an abundance of beetles, of which six or seven species do not occur below the tree-line. These strictly boreal species (*Hydroporus morio* Sharp; the beetle described by Sharp as *Hydroporus signatus* Mann., but in reality another species for which I suggest the name *appalachius; Deronectes griseostriatus* DeG.; *Agabus congener* Payk., and *tristis* Payk.) are often represented by hundreds of specimens.

Besides these boreal species, some thirty-five or more others are represented by occasional examples, of which no doubt many are simply visitors from the lower slopes and valleys just as the other

beetles which, when climatic conditions are just right, fly, or are carried by the wind up to the summits where they are found in the buildings or under whatever shelter offers at the top.

While I have not personally been successful in collecting in the merely temporary rain pools on the summit of Mt. Washington, presumably because it is too late, in September when I have been there, to expect these insect flights, Mrs. Slosson and others have taken many species of Dytiscidæ in them.

But the various "lakes" of the 5,000 foot level along the Presidential Range,—the Lakes of the Clouds on Mt. Washington; Starr Lake, smaller and more shallow in the col between Mt. Adams and Mt. Madison; Storm Lake, a mere puddle in the rocks on Mt. Adams; Peabody Spring, close to Storm Lake; and Spaulding's Spring on the side of Mt. Jefferson,—have never failed me, however cold or disagreeable the weather, and collecting in this region, with its rich yield of interesting species and with such a glorious setting of natural scenery on all sides, seems to me to be just about ideal.

ENVIRONMENT OF HYDROPHIDÆ.

By Fred. Wintersteiner,

Long Island City.

While all Hydrophilidæ except the sub-family Sphæridiini (which live on decaying plants or manure) are aquatic, swimming ability is found only in the genera *Hydrous, Tropisternus, Hydrophilus* and *Berosus,* the others crawling on submerged vegetation or clinging to various submerged objects. They exhibit a uniform dull coloration varying from piceous to testaceous, with very few exceptions, as in *Hydrobius tesselatus* and certain species of *Tropisternus* and *Berosus,* or in the dull cuprous tinge of some Helephorini. The underside of the last named is provided with a pubescence, retaining air which modifies their specific gravity and causes them to float to the surface, ventral side upwards, when the vegetation to which they cling is sufficiently disturbed to break their hold. According to European authors eggs are laid in cocoons, which in *Hydrous* and *Hydrophilus* float freely on the surface of the water, while in *Hydrobius*